

# TRAFFIC IMPACT STUDY REQUIREMENTS

## ***1.0 Purpose of the Traffic Impact Study***

The objectives of a TIS are to:

- Determine the appropriate location, spacing, and design of access points necessary to mitigate the traffic and operational impacts on the highway.
- Determine the need for any improvements to the adjacent and nearby roadway system to maintain a satisfactory level of service and safety and to protect the function of the highway system while providing appropriate and necessary access to the proposed development.

## ***2.0 Need for a Traffic Impact Study***

A traffic impact study shall be required as a condition of access permit approval when the full build out potential of the proposed development requesting access meets any or all of the criteria identified below. The full build out potential shall be defined as the complete development of available land for which proposed or future connections are accommodated in the development plan. Future development shall be assumed to be the future land use identified by the applicable comprehensive plan of the local planning and zoning jurisdiction; in the absence of such a plan future development shall be assumed to be at a similar type and density as the proposed development.

A traffic impact study shall not be a condition of approval for access permits serving single family dwellings, multiple family dwellings with 3 or less units and farm/field entrances.

**2.1** The proposed development is expected to generate greater than 100 vehicles per hour during its peak hour of operation based on trip generation estimates according to the most recent edition of the ITE Trip Generation Manual methodologies. In order to assist in the calculation of trip generation an excel spreadsheet (*TripGeneration.xls*) maintained by KYTC can be obtained from the district permit engineer. In addition, **Table 1** provides size thresholds for typical development types that have trip generation rates greater than 100 vph that may serve as a quick reference for the engineer/applicant. A trip generation report, consistent with section 4.2, may be prepared by the applicant demonstrating that less than 100 vph will be generated by a proposed development in lieu of the guidance provided in Table 1.

Table 1: Gross Floor Area Estimates generating 100 trip-ends per hour by Use

<b>Land Use</b>	<b>Threshold (&gt; 100 vph)</b>
<b>Industrial/Agriculture</b>	
<i>Industrial/Manufacturing</i>	130 1000 sf Gross Floor Area
<i>Warehouse</i>	95 1000 sf Gross Floor Area
<i>Industrial Park</i>	35 1000 sf Gross Floor Area
<b>Residential</b>	
<i>Single Family Housing</i>	90 Dwelling Units
<i>Multi-Family Housing</i>	140 Dwelling Units
<i>Retirement Community</i>	300 Dwelling Units
<b>Lodging</b>	
<i>Hotel</i>	160 Rooms
<i>Motel</i>	200 Rooms
<i>Resort Hotel</i>	175 Rooms
<b>Recreational</b>	
<i>Park</i>	175 Acres
<i>Theater</i>	3 Movie Screens
<i>Health/Sport Club/Gym</i>	35 1000 sf Gross Floor Area
<b>Institutional</b>	
<i>Day Care</i>	7 1000 sf Gross Floor Area
<i>School</i>	30 1000 sf Gross Floor Area
<i>Church</i>	70 1000 sf Gross Floor Area
<b>Medical</b>	
<i>Hospital</i>	50 1000 sf Gross Floor Area
<i>Nursing Home</i>	300 Beds
<b>Office</b>	
<i>General Office Building</i>	60 1000 sf Gross Floor Area
<i>Office Park</i>	60 1000 sf Gross Floor Area
<i>Medical-Dental Office</i>	100 1000 sf Gross Floor Area
<b>Retail/Service</b>	
<i>Hardware/Home Improvement Store</i>	25 1000 sf Gross Floor Area
<i>Shopping Center/Retail</i>	5 1000 sf Gross Floor Area
<i>Supermarket</i>	6 1000 sf Gross Floor Area
<i>Sit-Down Restaurant</i>	5 1000 sf Gross Floor Area
<i>Fast-Food Restaurant</i>	2 1000 sf Gross Floor Area
<i>Bank</i>	5 1000 sf Gross Floor Area
<i>Gasoline/Service Station</i>	6 Fueling Positions

**2.2** The proposed access location does not meet the spacing identified in Table 2 per its functional classification.

Table 2: Access Spacing<sup>1</sup>

Functional Classification	Signalized Intersection Spacing	Full Access	Directional Access <sup>1</sup>	Restricted Access <sup>2</sup>
<b>Urban Roadways</b>				
Principal Arterial	2,400	2,400	1,200	1200/600 <sup>3</sup>
Minor Arterial	2,400	2,400/1,200 <sup>3</sup>	1,200/600 <sup>3</sup>	600
Collector	1,200	600	300	300
Local	1,200	150	150	150
<b>Rural Roadways</b>				
Principal Arterial	2,400	2,400	1,200	1200
Minor Arterial	2,400	2,400	1,200	600
Collector	1,800	900	450	450
Local	1,200	150	150	150

Notes: 1. Directional access only provides for left-in, right-in and right-out movements only.  
 2. Restricted access only provides for right-in and right-out movements only.  
 3. For roadways with an 85<sup>th</sup> percentile speed greater than or equal to 45mph, use larger values. For roadways with an 85<sup>th</sup> percentile speed less than or equal to 45 mph, the larger values should be utilized where feasible but the lower values may be applied, where necessary.

The requirement for a traffic impact study based on access spacing may be waived by the district permit engineer if the applicant can provide documentation that a) the access location is necessary due to a pre-existing condition and not the results of current property owner or applicant; b) there are no reasonable engineering or construction alternatives to provide access to the site and c) there is no existing access to the site or the request will replace an existing access point, improving safety and operations.

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<sup>1</sup> Kentucky's Proposed Access Management Program, 2006

**2.3** The access plan proposes a change in the traffic control on a state maintained roadway including:

- Installation, removal or relocation of a stop or yield signs on an existing public street.
- Installation, removal or relocation of a traffic signal installation.
- Changes in the timing and/or phasing of an existing traffic signal or signal system.
- Installation, or modification to a modern roundabout or other intersection control designs.

**2.4** When a proposed development does not meet the conditions of sections 2.1, 2.2 or 2.3, above, but is deemed necessary by the district permit engineer. A TIS may be required due to known congested locations, operational and safety concerns in the area of the proposed development, and special conditions such as sensitivity to adjacent residential areas, or proximity to major planned roadway improvements in the area.

### **3.0 Study Area**

The following sections identify the minimum study area to be addressed by a Traffic Impact Study. The district permit engineer may adjust the minimum study area as appropriate to the development size, specific site conditions and/or local and regional issues and policies. The applicant may extend the minimum study areas described below to demonstrate potential benefits of the proposed access plan to the KYTC and the community.

**3.1** When a development meets the criteria established in sections 2.1, due to traffic volumes, the study area for the TIS shall include all proposed access points to the development and shall extend to the first full median opening or signalized access point within 4800 feet in all directions along the intersecting roadway. The first adjacent partial, Left-in/Right-in, Right Out (LI-RIRO) or Right-in, Right-Out (RIRO) access in both directions shall also be included in the study area.

**3.2** When a development meets the criteria established in section 2.2, due to access spacing deviations, the study area for the TIS shall include the proposed access point, which does not meet applicable standards, and shall include access points or public streets within the distance specified in Table 2.

**3.3** When a development meets the criteria established in section 2.3, due to modifications to traffic control, the study area for the TIS shall include 1) all access points to the proposed development, 2) all access points adjacent to the proposed access points on both sides of the street and 3) the first controlled

access points on the adjacent roadway network in all directions, within 4800 feet in any direction along the adjacent roadway network.

When Staff determines that the signal modification will affect the operation of a coordinated signal system, the study area shall include all affected signals within the system. A coordinated signal system may be considered to be affected when

1. The proposed signal would require a different cycle length than currently in use to attain an acceptable LOS as defined in Section 5.
2. The proposed signal would require adjustment of existing intersection offsets to attain acceptable corridor performance as defined in Section 5.
3. The proposed signal would require a change in the timing and/or phasing of adjacent intersections

**3.4** When a TIS is required by the district permit engineer as outlined in section 2.4, the study area shall be established to address the specific issues for which the study was required.

The final study area shall be established at the pre-study meeting as outlined in section 6.

## ***4.0 Study Requirements***

### **4.1 Analysis Scenarios**

The TIS shall examine the existing conditions, as well as conditions within the study area before and after the proposed development for the anticipated year of opening and design year 10 years after opening. The before and after conditions shall be termed the “No Build” and “Build” conditions. Analysis shall be completed to a degree sufficient to document the operational and safety impacts of the proposed development and access plan.

The existing conditions analysis shall include existing traffic volumes and traffic control. The existing condition shall be used to calibrate and validate the analysis model. Calibration shall be made with regard to at least two of the following factors:

- Intersection Queues
- Corridor Travel Speed
- Corridor/Intersection Delay
- Vehicle Headway

Should discrepancies exist between the existing conditions analysis output and observed values, modifications to the analysis procedures should be established with the district permit engineer to accurately reflect the conditions in the field.

The No Build condition shall include existing traffic volumes forecasted to the appropriate analysis year, existing roadway geometry and all applicable traffic control devices. The No Build analysis shall include any traffic generated by approved adjacent developments as well as any planned and funded infrastructure improvements within the study area. The No Build condition shall also include any Transportation System Management (TSM) improvements, such as signal timing and/or phasing optimization and reconfiguration of existing lane uses that may improve the operation of the transportation system.

The Build condition will include No Build traffic volumes plus site generated traffic and any access improvements proposed with the development.

No Build and Build analysis shall be conducted for the anticipated year of opening and a design year assuming a 10 year horizon beyond the year of opening. Opening year Build analysis should only include that portion of development which is anticipated to be completed at opening. Design year analysis should include the full build-out potential of the development. In the event that the full build-out of the development is anticipated to extend beyond the 10-year horizon, the design year shall be the anticipated year of full build-out.

All scenarios evaluated should include analysis of the weekday AM and PM peak hours. When a proposed development is anticipated to generate a high volume of traffic during non-traditional peaks, such as a noon peak, late night or weekend peak period, these periods should also be examined. The need to study additional periods of operation shall be at the discretion of the district permit engineer.

The final analysis scenarios and design years shall be established at the pre-study meeting as outlined in section 6.

## 4.2 Data Collection

The data collection efforts for the study shall be consistent with the level of analysis required. At a minimum this should include 2-hour turning movement counts conducted in 15-minute intervals at all study intersections for all peak periods examined. Additional data needed to provide calibration of simulation models, as outlined in section 4.1 shall also be collected for all analysis periods. Typical weekday counts should be done from 7:00AM-9:00AM and 4:00PM-6:00PM on Tuesday, Wednesday or Thursday unless otherwise specified by the district permit engineer based on known traffic conditions. Previously collected data and traffic volumes may be used in the analysis at the discretion of the district permit engineer.

## 4.3 Trip Generation and Distribution

**4.3.1 Trip Generation.** Trips generated by the proposed development shall be calculated using the most current edition of the *ITE Trip Generation Report* methodologies. In order to assist in the calculation of trip generation, internal capture rates, and pass-by trips, an excel spreadsheet (*TripGeneration.xls*) maintained by KYTC can be obtained from the district permit engineer. The spreadsheet provides calculations for all land uses that meet the requirements of this section. A copy of Tables 1 and 2 in the spreadsheet shall be provided in the report.

The following guidelines shall apply to Trip Generation Estimates.

1. Trip Generation shall be determined through application of the KYTC\_TripGeneration.xls spreadsheet. The spreadsheet provides AM and PM peak hour trip generation rates for all acceptable land use data.
2. When multiple land use codes may be applied to a particular land use, such as ITE Code 853, Convenience Market with Gasoline Pumps, and ITE Code 945, Gasoline Service Station with Convenience Market, the land use which provides the higher trip generation rate shall be used.
3. When a proposed development contains multiple land uses, an aggregate land use code such as ITE Code 820 Shopping Center or Code 750 Office Park, shall be used if available. No internal trip capture rates shall be used for an aggregate land use code.
4. Trip Generation rates shall only be used when six or more data points are provided in the *ITE Trip Generation Report*. Trip generation rates not provided in the spreadsheet do not meet minimum data requirements. When the ITE trip generation rates cannot be used, these data points shall be supplemented with the collection of local trip generation data for similar land uses.
5. When the proposed land use is not compatible with any ITE land use code definition, local trip generation data shall be collected for similar land uses. A

minimum of three local data points shall be collected and the maximum rate of the three data points shall be used in estimating trip generation.

6. Local supplemental data must be collected in accordance with the recommended data collection procedures of the *ITE Trip Generation Handbook*. Supplemental data and trip generation calculations shall be provided in the appendix of the report.

7. Excerpts of the utilized Trip Generation Manual section shall be provided in the appendix of the report.

**4.3.2 Internal Trips.** For multi-use developments that contain a mixture of office, retail and/or residential uses within a contiguous study area, internal trips may be calculated and deducted from the total trips generated. Internal trips reflect the amount of generated traffic that travel between the multiple uses in a proposed development.

1. Internal capture rates shall be determined through application of the KYTC\_TripGeneration.xls spreadsheet. The spreadsheet determines internal capture rates consistent with available AM and PM data provided in the Trip Generation Handbook.

2. When a proposed development contains multiple land uses, an aggregate land use code such as ITE Code 820 Shopping Center or Code 750 Office Park, shall be used if available. No internal trip capture rates shall be used for an aggregate land use code.

3. Internal captured trips shall be reduced from the total trips generated before any reduction of pass-by trips.

**4.3.3 Pass-by Trips.** Pass-by trip estimates may be used to account for existing trips on the roadway network that may access the proposed site as they pass-by on their intended route. As such pass-by trips will be accounted for in the driveway traffic volumes, but will not added to the adjacent street system. (Procedures for distributing pass-by trips are provided in the section 4.3.4). The reduction of diverted link trips from the roadway system shall not be used, as the study area shall only include the adjacent roadway network and these trips will be identical to primary trips.

1. Pass-by trip rates shall be determined through application of the KYTC\_TripGeneration.xls spreadsheet. The spreadsheet determines pass-by trip rates consistent with available AM and PM data provided in the Trip Generation Handbook. Average pass-by rates are only calculated when 6 or more data points are provided. When diverted link trips and pass-by trips are not reported separately in the data, the pass-by percentage for that data point shall be estimated to be 50 percent of the reported rate.



2. For land uses and analysis periods that do not have 6 or more pass-by trip data points provided in the *ITE Trip Generation Report*, the pass-by trip rate shall be zero (0). Supplemental local data may be collected for additional uses. Local supplemental data must be collected in accordance with the recommended data collection procedures of the *ITE Trip Generation Handbook*. A minimum of 100 pass-by trip surveys should be collected for each local data point collected. Supplemental data and average pass-by rate calculations shall be provided in the appendix of the report.

**4.3.4 Trip Distribution.** Trips generated by the development should be distributed onto the public roadway network consistent with existing traffic patterns in the area as prescribed below.

1. Identify existing directional traffic volumes and total frontage volumes at all proposed access points.
2. Determine entering trip distribution percentage based on approaching directional volumes at each access point.
3. Trace entering trip distribution percentage through system proportionate to turning movement volumes at intersections. For developments having two access points on a single roadway, the first access point in the direction of travel shall service 75 percent of the total approach traffic, and the second access point shall serve the remaining 25 percent. For developments having three or more access points on a single roadway, distribution among the access points shall be determined by the service area of each access point and the land uses it service.
4. Determine exiting trip distribution percentage based on approaching directional volumes at each access point.
5. Trace exiting trip distribution percentage through system proportionate to turning movement volumes at intersections.
6. Distribute pass-by trips at access points in accordance with trip distribution.  
*Note: Pass-by trips are not added to any movement other than those entering or exiting the access point(s).*
7. Reduce pass-by trip volume from accompanying diverted movement at access point. *Note: Pass-by trip reductions are not taken at any other intersection or movement other than from the movement from which the trip was diverted at the access point.*
8. Distribute entering primary trips on system in accordance with trip distribution.
9. Distribute exiting primary trips on system in accordance with trip distribution.
10. Determine final opening day traffic volumes by summing existing traffic, pass-by trips and trips generated (entering and exiting).

11. Determine design year no build traffic volumes by applying forecasted growth rate to existing traffic volumes.

12. Determine final design year traffic volumes by summing future (No Build) traffic, pass-by trips and trips generated (entering and exiting).

Figures 1 through 9 summarize the trip distribution process described above. Similar figures shall be prepared for all studies. This methodology may be revised with more refined distribution methodologies at the discretion of the district permit engineer. However, the result of the prescribed distribution shall be included in the report with documentation and justification for proposed modifications.

#### **4.4 Design Year Forecast**

The design year analysis shall forecast background traffic volumes based on historical growth patterns. The design year shall assume a 10 year horizon beyond the year of opening. In the event that the full build-out of the development is anticipated to extend beyond the 10-year horizon, the design year shall be the anticipated year of full build-out. The future year forecast shall be determined through the use of the forecast.xls spreadsheet provided on the KYTC division of planning website. This spreadsheet calculates the weighted average annual rate provide by exponential and linear growth models.

1. The spreadsheet requires a minimum of 4 annual ADT records over the previous 15 year period. In the event that 4 data points are not available, current year data can be collected and used in the forecast, provided appropriate seasonal and daily adjustment factors are applied to convert the collected data to AADT.

2. If adequate data does not exist, data from a minimum of two adjacent roadways should be analyzed to determine the average growth rate. In the absence of available data, county wide growth rates, provided by functional class shall be used.

3. The projected growth rate shall not be less than zero (0) percent per year.

4. If based on this methodology a project growth rate exceeds three (3.0) percent per year, the district permit engineer shall coordinate with the Division of Planning to check and develop an appropriate growth rate.

#### **4.5 Coordination**

The final study requirements and methodologies shall be established at the pre-study meeting as outlined in section 6.

## **4.6 Operational analysis**

Operational analysis shall be conducted for all analysis scenarios identified in section 4.1. At a minimum, operational analysis shall include but is not limited to:

**4.6.1** Intersection level of service (LOS) analysis shall be conducted for all intersections in the study area. LOS analysis should be consistent with Highway Capacity Manual(HCM)/Highway Capacity Software (HCS) methodologies for unsignalized and signalized intersections. Roundabout analysis shall be consistent with KYTC policies. Analysis results should be summarized with LOS and delay by lane-group and intersection. For Roundabout analysis, LOS shall be determined using both signalized and unsignalized HCM thresholds.

**4.6.2** Queuing analysis shall be conducted for all controlled movements (stop, yield, signal) in the study area. Queuing analysis should report 95<sup>th</sup> percentile queues for all scenarios and periods examined, and identify any conflicts between adjacent queues and access points.

**4.6.3** Turn lane analysis shall be conducted for all unsignalized access points to the proposed development. This analysis shall determine if a right or left-turn lane is warranted at a location to improve operations or safety and shall identify the proper length of turn lane to accommodate any storage or deceleration requirements. Turn lane analysis shall be conducted in accordance with the standards used by the KYTC.

**4.6.4** Signal warrant analysis shall be conducted for all existing and proposed traffic signals providing access to the development. Signal warrant analysis shall also be required before any existing traffic signal is removed. Signal warrant analysis shall be conducted in accordance with most recent version of the *Manual on Uniform Traffic Control Devices*.

**4.6.5** When a TIS is required under the conditions of section 2.3, due to modifications to traffic control, corridor level analysis shall be provided. At a minimum this is to include estimated average travel speed for the corridor. Corridor analysis shall be conducted using the latest version of Synchro, TSIS or VISSIM software. Additional analysis or simulation methods may be required or approved by KYTC staff.

## **4.7 Safety Analysis**

When the study area includes a corridor or intersection which has been identified as a high accident location or on a high accident corridor by the KYTC or the District personnel, safety analysis shall be conducted and included in the TIS. Safety analysis shall be conducted using the three most recent years of crash data available. Engineering judgment should be used when reviewing and analyzing existing crash patterns in areas where improvements have been implemented within the period of the crash data. At a minimum the safety analysis will include but is not limited to:

1. Determination of crash rates and critical rate factors (CRF) for the subject location
2. Statistical analysis of crash data by time, light conditions, day of week, pavement conditions, crash type and contributing factors.
3. Development of crash diagrams based on crash reports. This should also include analysis of the roadway environment to identify factors which may contribute to significant recurring crashes at the location.
4. Identification and analysis of potential impacts associated with site traffic and/or the proposed access plan on the existing crash patterns.

## **5.0 Mitigation**

When a proposed development and/or access plan is shown to result in an unacceptable level of service, or significantly deteriorate the operations of adjacent access points or corridors, the applicant shall identify the extent of mitigation improvements necessary to offset the impact of the development.

Mitigation improvements may include, but are not limited to, modification to signal systems, construction of additional lanes or medians, access roads, shared access drives, etc. When mitigation improvements are proposed analysis shall be conducted for the Build condition for the year of opening and the design year with the proposed improvements. This analysis shall be consistent with and in addition to the No Build and Build analysis required in section 4.0.

## **5.1 Operational Thresholds**

The following provisions shall be used to define thresholds for acceptable operational performance under the Build condition within a study area.

At existing intersections, average intersection delay shall not exceed 80 seconds and shall not increase more than 30 percent over the No Build condition. Delay for individual turning movements and lane groups shall not exceed 80 seconds. In such cases where intersection delay or individual turning movements are shown to operate with delays greater than 80 seconds under the No Build condition, delay shall not increase.

Proposed intersections shall operate at intersection LOS C or better. Delay for individual turning movements and lane groups shall not exceed 80 seconds.

On existing corridors the travel speed in each direction shall not decrease by more than 15 percent of No Build condition and shall not operate at or below LOS D as defined in Table 1, below. In such cases where the existing corridor is shown to operate at or Below LOS D, the travel speed shall not decrease.

On proposed corridors, the corridor shall not operate below LOS C, as defined by Table 3, below. .

Table 3: Level of Service Definitions; Average Travel Speed

LOS	Facility Speed Limit					
	50	45	40	35	30	25
A	42	39	35	30	26	21
B	38	34	32	26	21	19
C	31	27	25	20	16	13
D	24	21	20	16	13	9
E	19	16	15	12	9	7
F	<19	<16	<15	<12	<9	<7

## 6.0 Responsibility for the Traffic Impact Study

The completion of the TIS is the responsibility of the access permit applicant. The report shall be completed by a consultant prequalified in Traffic Impact Studies by the Kentucky Transportation Cabinet. Each report shall contain the stamp, signature and date of the responsible engineer.

### 6.1 Pre-Study Meeting

It is required that a pre-study meeting with the district permit engineer be conducted prior to starting a Traffic Impact Study. The applicant will be required to provide an aerial and map of the roadway network within a 1 mile radius surrounding the proposed site to enable meaningful decisions by staff at the meeting. At this meeting the following parameters of the TIS will be determined:

- Study Area
- Analysis Periods (AM, PM, Noon, Weekend)
- Trip Generation Methodology
- Trip Distribution Percentage Methodology
- Background and Build-out Study Year
- Traffic Growth Rates
- Adjacent/Approved Developments
- Future Highway Projects in Study Area
- Analysis Software/Tools
- Safety Analysis Locations
- Operational Analysis Parameters

It is at this meeting, that any potential issues regarding the report should be discussed. Following the meeting, the applicant will prepare a memo of understanding summarizing the conclusions and parameters established in the pre-study meeting that shall be used to complete the study with approval of the district permit engineer.

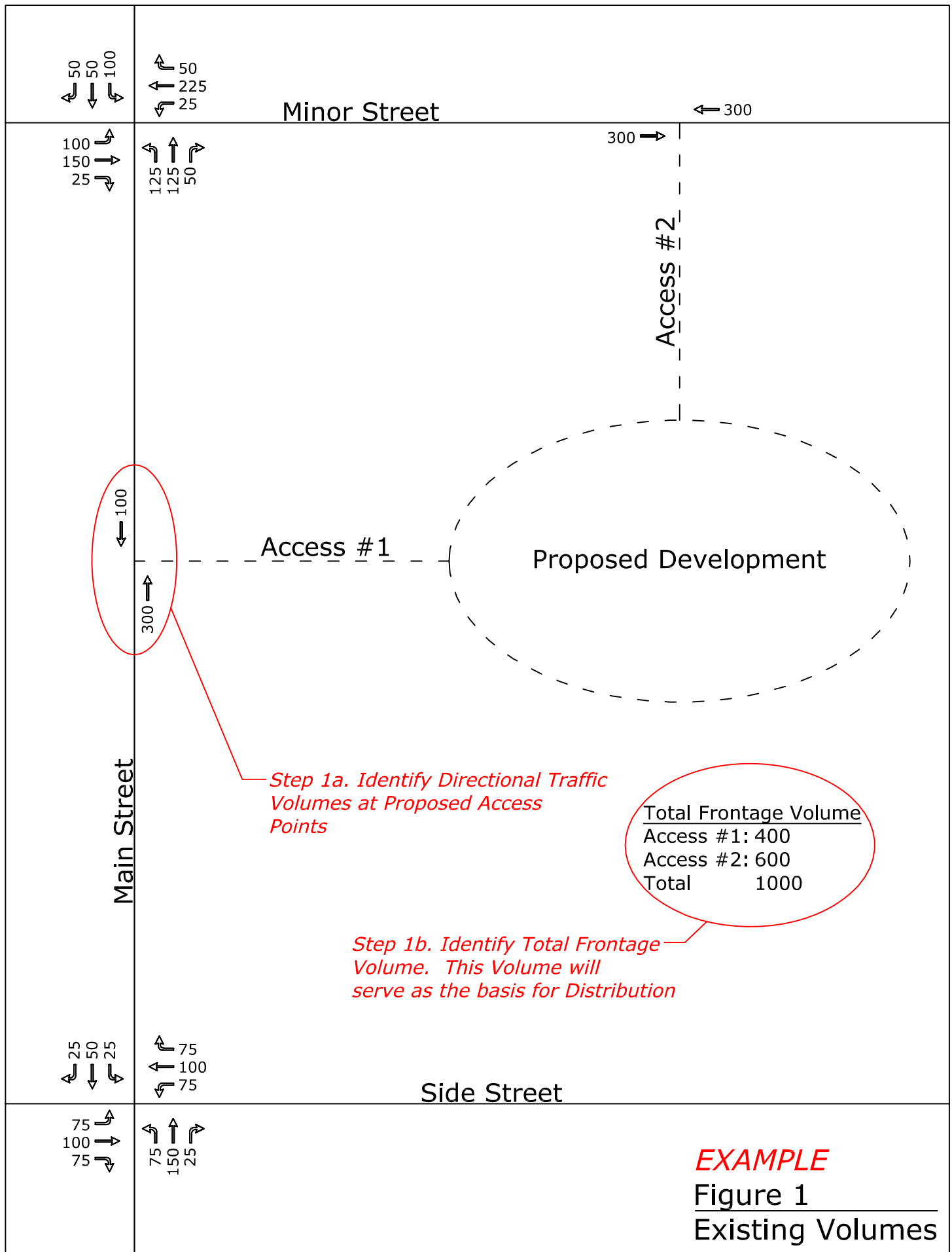
It is the responsibility of the applicant to schedule this meeting prior to submission. If a pre-report meeting is not conducted, the report may not be accepted and the permit denied.

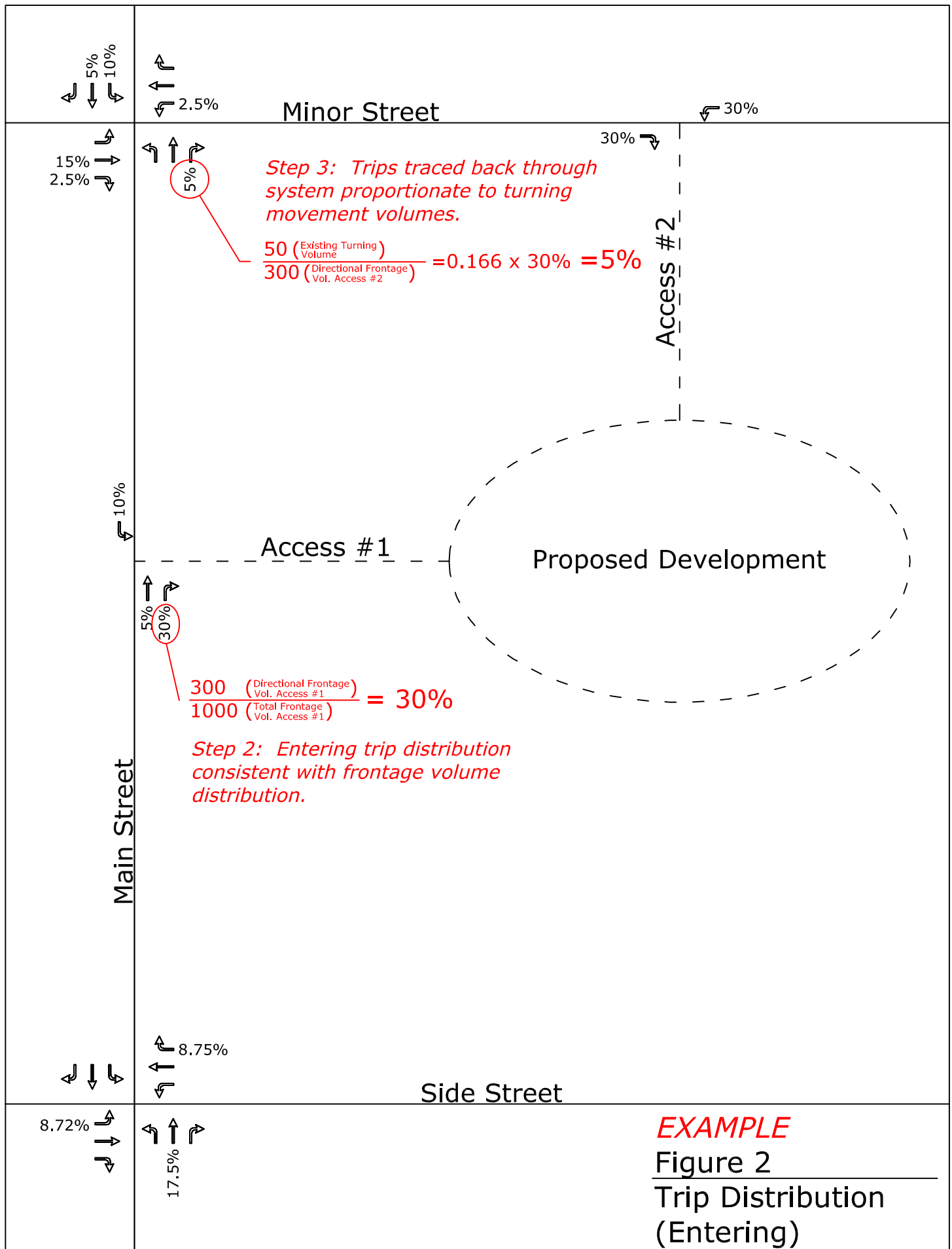
## **6.2 Documentation**

The results of the Traffic Impact Study shall be documented in the Traffic Impact Study Report. This report should contain:

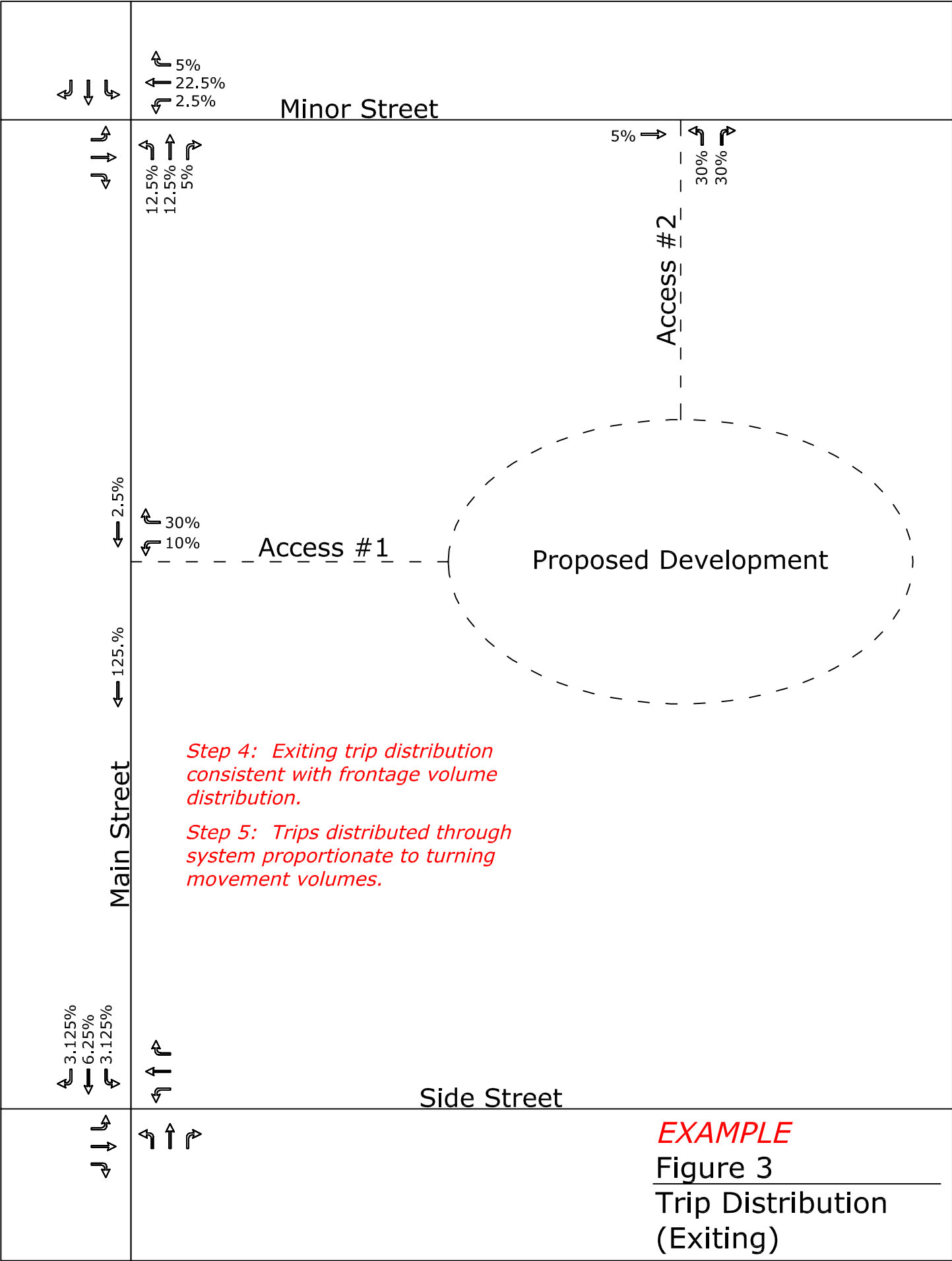
- Summary of proposed development
- Data collection methodologies
- Summary of existing traffic conditions
- Summary of No Build Conditions including growth rates and approved developments.
- Raw Traffic Data (may be included in appendix)
- Trip Generation Calculations and Summary
- Trip Generation/Distribution Methodology (shall include graphics showing existing traffic volumes, generated trips and total trips for all scenarios as shown in Figures 1 through 9).
- Traffic/safety analysis methodologies
- Summary of traffic analysis results
- Full Output/Calculations from traffic/safety analysis (may be included in appendix)
- Operational Analysis Software files.
- Summary of recommended improvements
- Concept plan showing proposed improvements. Concept plan shall show proposed improvements over aerial (if available) to a measurable scale not greater than 1" = 100'. Figures

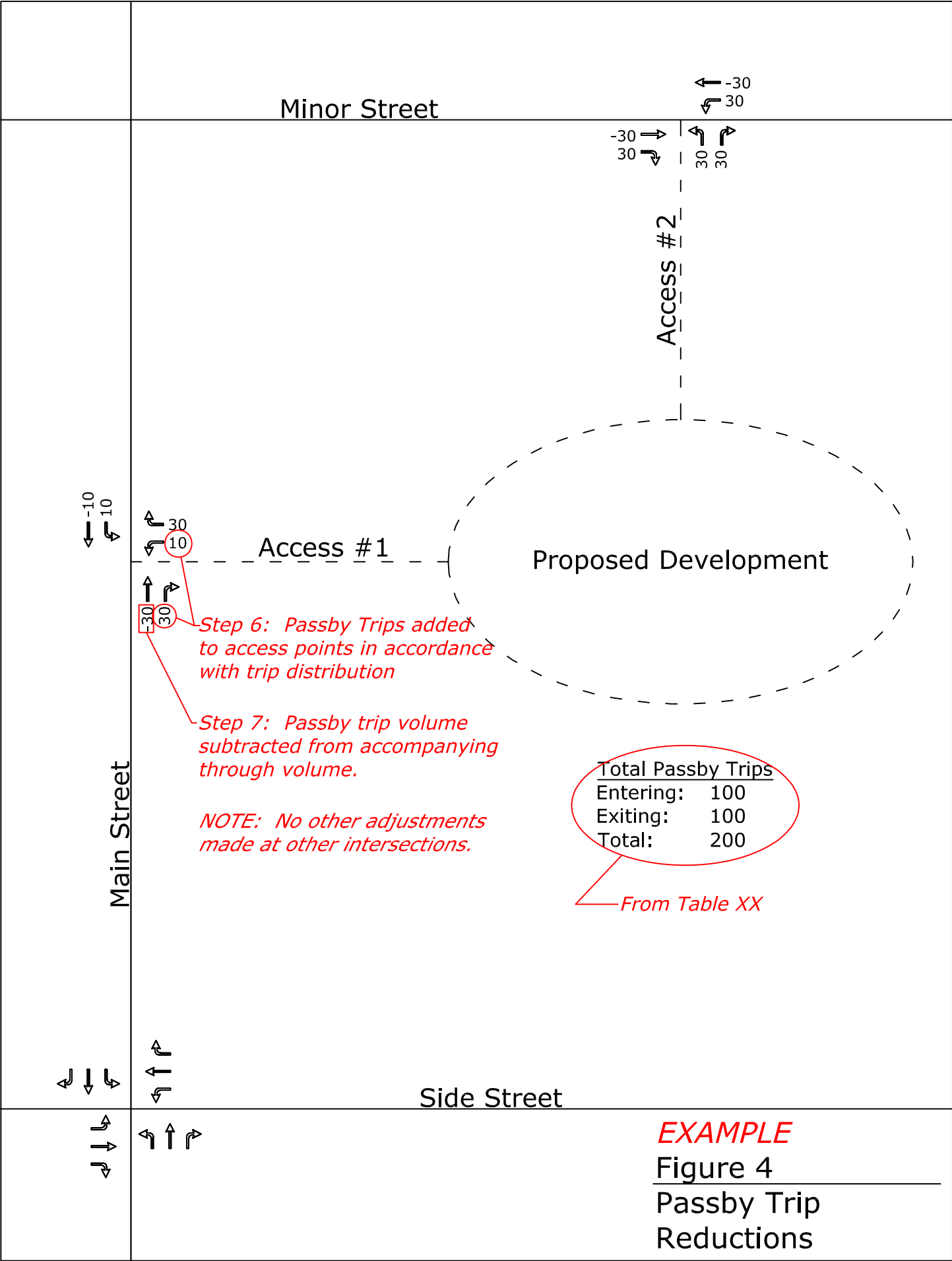
In addition to this documentation, a summary memorandum may be required;. This memorandum shall document the improvements to be made, by either the applicant or KYTC, and the resultant operational impacts should they differ from the full range of improvements identified in the report.



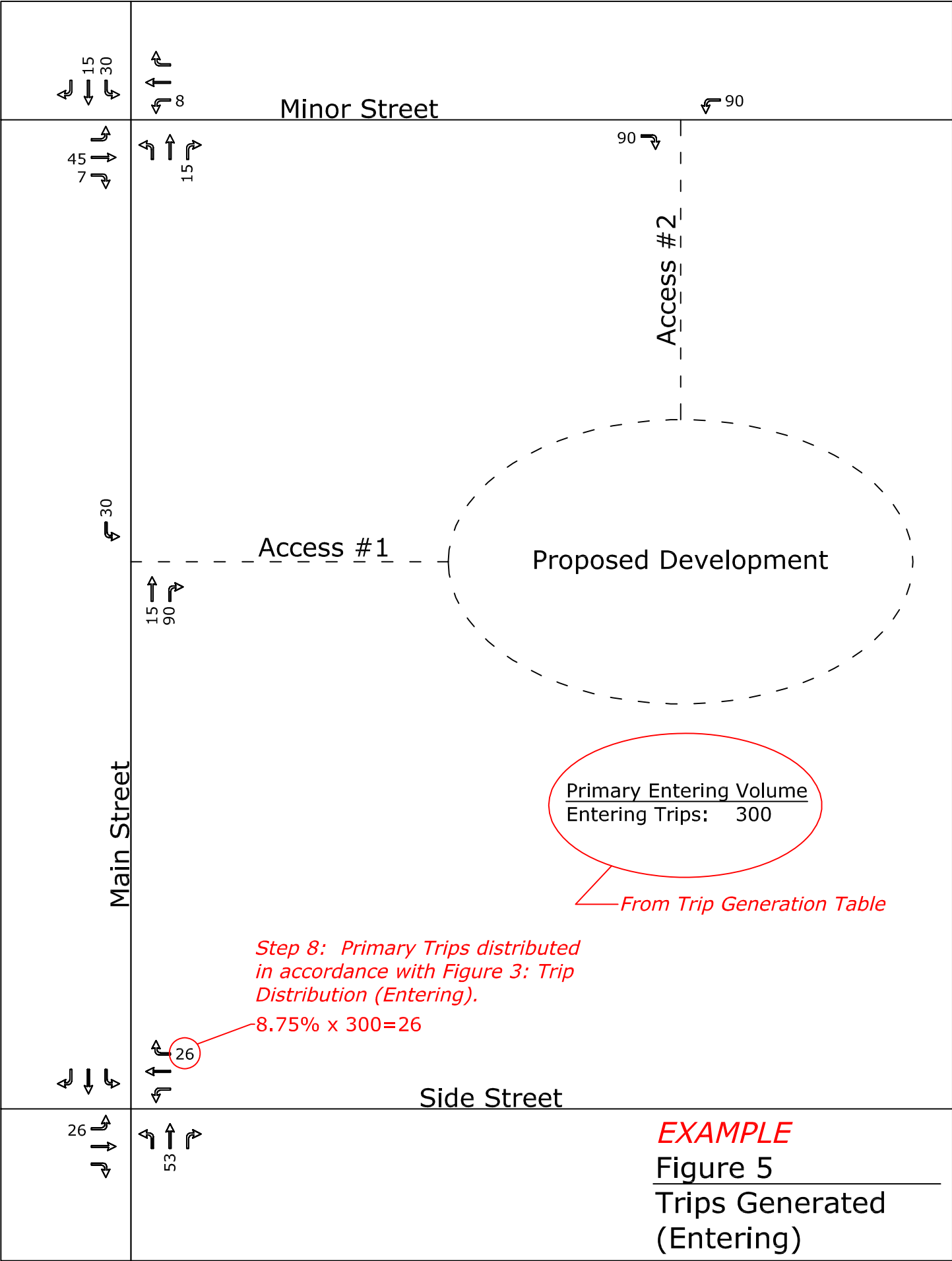


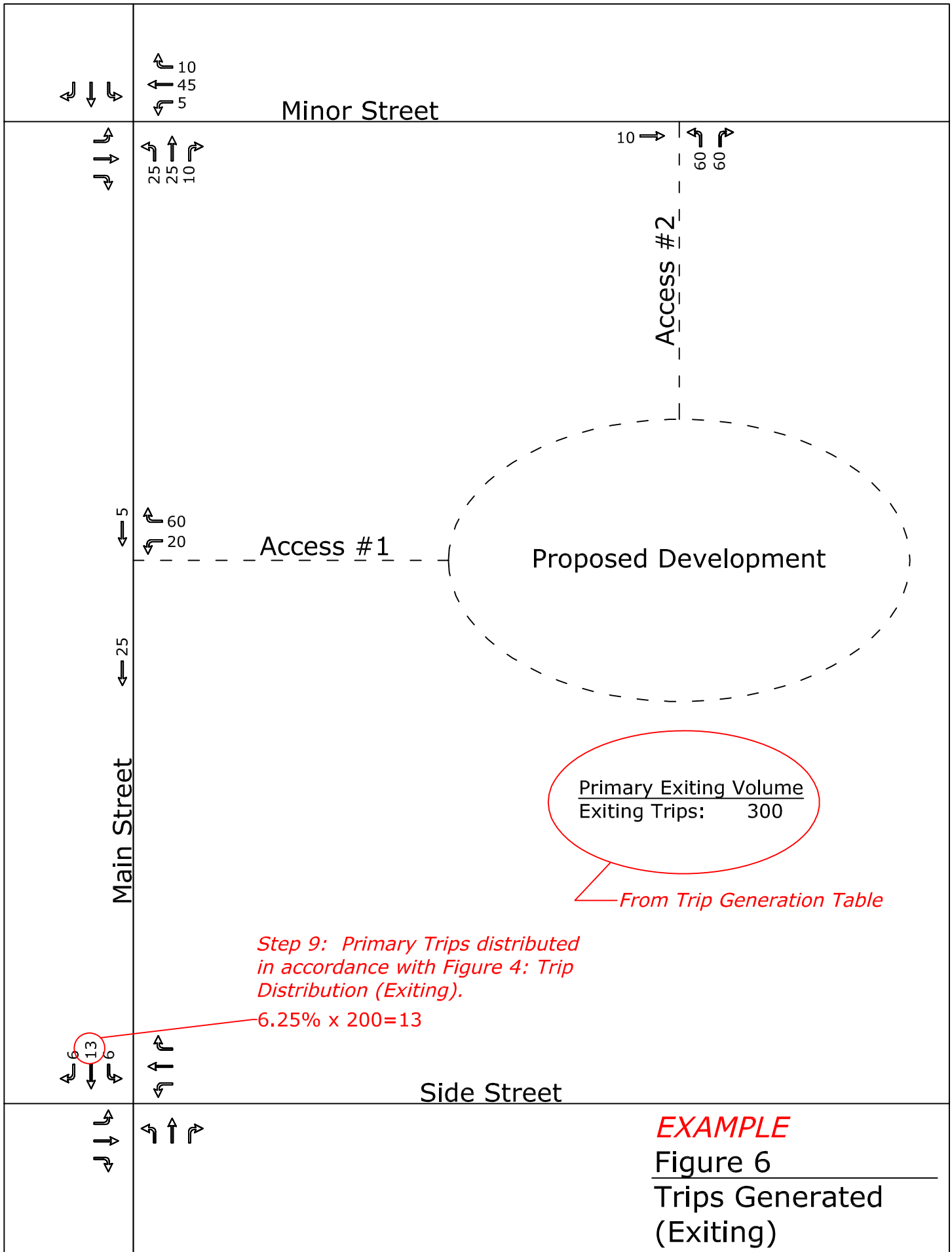


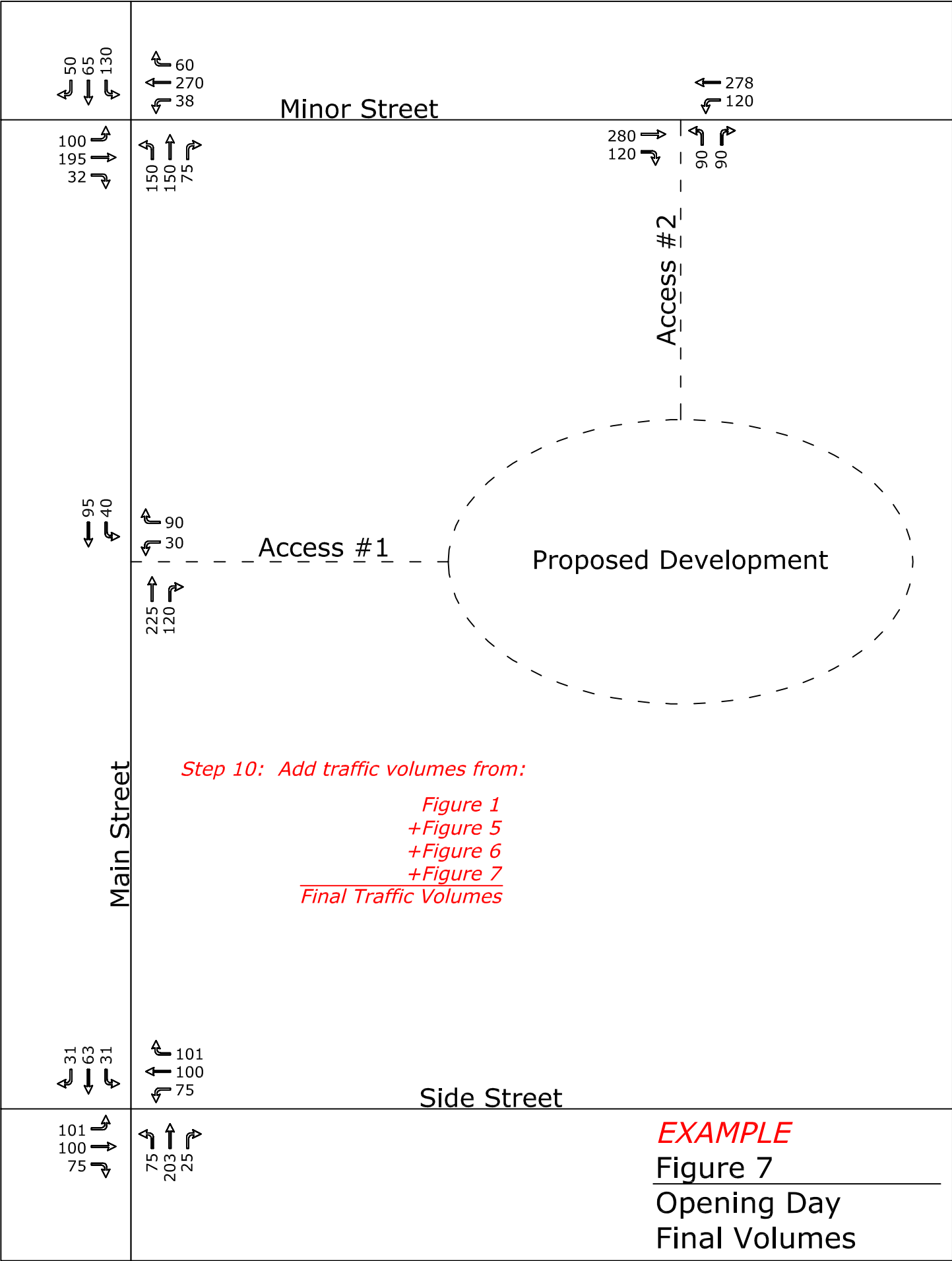


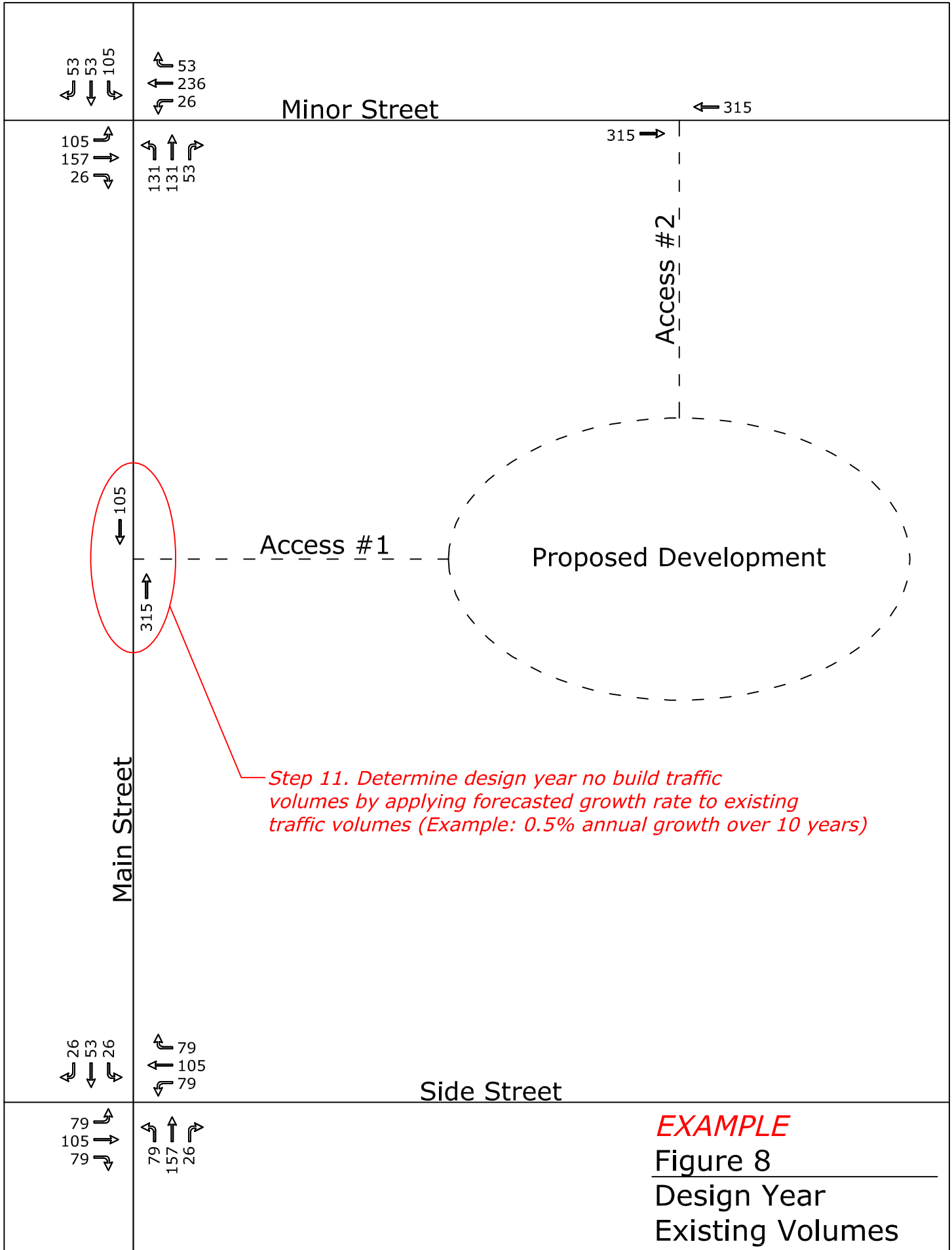


**EXAMPLE**  
Figure 4  
Passby Trip  
Reductions









Step 11. Determine design year no build traffic volumes by applying forecasted growth rate to existing traffic volumes (Example: 0.5% annual growth over 10 years)

